Genotype and beef attributes

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Research Institute: ARC-Animal Production Institute

Research focus area: Animal Products, Quality and Value-adding

Full Title of the project

NFSC014. The effect of genotype on beef colour, surface morphology (texture), pathology, shelf life, tenderness and juiciness

Aims of the project

- To determine genotypic differences in meat colour, morphological structure, pathology and resulting shelf life.
- To determine consumer prevalence on the grounds of colour, texture and acceptability between South African pure beef genotypes
- To determine if an association exists between colour, surface structure (morphology) and tenderness
- To determine the possibility to predict beef tenderness with experienced vision or by means of other technological measuring of surface morphological myofibre structure

Executive summary

The effect of genotype on beef colour, surface morphology (texture), pathology, shelf life, tenderness and juiciness.

The study describes the relationship between visual and instrumental measurements for colour and tenderness between 5 South African beef breeds; Bos indicus (Brahman), Sanga type (Nguni), British Bos taurus (Angus), European Bos taurus (Charolais) and the composite (Bonsmara), 10 animals per genotype, n=50. The carcasses were split and the right sides were electrically stimulated and left sides not stimulated, but delay chilled. Steaks were aged till 3 days (d) post mortem (pm) on polystyrene plates and till 9, 14 and 20 d pm in vacuum bags. The steaks were evaluated by visual analysis for colour, marbling, fiber separation, surface texture and structure integrity using a 10 member trained panel. Colour was also measured by Minolta spectrophotometer and tenderness was measured by shear force using Instron. Good correlations were observed between the visual colour and L* (r= 0.809), b* (r= 0.698) and hue (r= 0.797). There were also correlations between shear force and structure integrity (r= -0.410) and fiber separation (r= -0.401). Very low correlations were observed between colour and shear force (r= -0.242). Therefore although consumers could judge meat colour by visual analysis, it seems not possible to predict tenderness by colour judgement. There is potential for an experienced eye in predicting tenderness by observing visual structural properties such as fibre separation and structural integrity. It is clear from the results that there is very little relationship between meat colour and tenderness.

Visual characteristics which included the fiber separation, the surface texture and the structure integrity were expected to have a similar pattern as the shear force measurements (increase/decrease with ageing). The structure integrity does show a similar pattern with shear force measurements but the day 14 and 20 were similar. From the observed results, differences can be picked up from the different packaging types. For all the visual characteristics, even though no clear pattern could be observed between the vacuum packaged aged steaks (day 9, 14 and 20), there was clear significant differences between the packaging types which the panel was able to pick up.

Colour and morphological evaluation of the steaks by the trained visual panel revealed that significant differences were observed between breeds. The colour differences came as no surprise because as expected the Brahman steaks were the lightest and the Nguni was the brightest with Angus, Bonsmara and Charolais in between. Minolta measurements for L* (lightness), b* (blue to yellow) and hue angle (discolouration)

correlated with the panel observations, but a* (green to red) and Chroma (intensity of red colour) did not correlate.

From results of the study, it can be observed that breed means had significant effect on the surface visual characteristics (marbling, fiber separation, surface texture and structure integrity) and Warner Bratzler shear force measurements. All these observations increased from day 3 and 9 post mortem to day 14 and 20 post mortem for all the breeds. The differences observed in these breeds could be due to the properties of the muscle proteolytic enzyme systems (calpain system) (Whipple et al, 1990; Koohmaraie, 1996) under the specific post slaughter procedures chosen for this study that was advantageous towards the Brahman, Nguni and Angus, but a little less so for the Bonsmara and Charolais, showing that it is important to choose the right slaughter conditions according to the breed characteristics.

In conclusion, the type of breed does result in colour differences in the meat, but shelf life characteristics did not differ. It is also evident that consumers can judge meat colour accurately by visual observation. It could be more difficult for consumers to predict meat tenderness visually by using surface structural observations (fiber separation and structure integrity) but there is potential for visual tenderness prediction with proper training. It is clear from the results that there is very little relationship between meat colour and tenderness.